total heat effect, from integration of curve **186**, is 85 mcal ±0.1%. The solid curve through the calculated values of **186** is the shape of the known electrical heat effect. The same values of **186** can be obtained from the program "Scan" in the solute mode by proper manipulation. At least two effects of the computer calculation are seen in FIG. **7**; the nonconstant baseline voltage effect is removed since the difference between **182** and **184** is zero outside the $t_1 \rightarrow t_2$ range; the slowly changing voltage following t_1 and t_2 on **184** is due to the time response of the sample cell, and is corrected for in the computer program, yielding the correct square wave shape of **186**. These are the two major effects of the computer program "Scan" during the transformation of the calorimetric raw data (T, V, t) into the desired heat capacity as a function of temperature.

In another embodiment, the differential scanning calorimeter of the invention is interfaced with a PDP 11/10 minicomputer whereby the entire experimental procedure is automated. As a result, approximately forty times as much voltage data is collected at a considerably faster rate. Calorimeter precision is thereby improved through the concomittant noise reduction (from ±25 μcal/degree to approximately ±4 μcal/degree), and furthermore the shape of the heat capacity curve is more precisely defined.

The addition of a microprocessor to control the calorimetric experiment also results in a major improvement in the reproducibility of the scanning rate from the original ±3-4% to ±0.03%. This is accomplished by replacing the constant voltage regulated power supply **162** which heats the heaters **146**, **148** and **150** with a programmable power supply under the control of the microprocessor. A conventional programmable power supply may be used, e.g. such as a KEPCO, Inc., Flushing, N.Y. model number JQE 0-100 v, 0-1A unit. The minicomputer then accepts digital temperature data from thermometer **168**, calculates in real time the instantaneous temperature scanning rate α, and generates a precise temperature scanning control signal. This signal is then applied by means of a digital-to-analog converter to the programmable power supply which in turn powers the heat sink heater elements **146**, **148** and **150**.

As a result of the improved reproducibility of the scanning rate α, this calorimetric parameter can be assumed to be identically constant for each of the baseline, solvent and solute temperature scans. Accordingly, during data analysis it is no longer necessary to compensate for variations in α, and the analysis is thereby significantly simplified.

Yet another substantial benefit derived by the introduction of the microprocessor into the calorimeter system is the fact that highly accurate negative temperature scans, i.e. from high temperature to low temperature, may be possible. This is accomplished by using the refrigerated water bath **176** in conjunction with the cooling coils **30**, **32** to establish control of the negative temperature scan. The digital-to-analog feedback control system discussed above is then employed to tightly control the constancy and accuracy of the rate of temperature decrease of the calorimeter.

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A differential scanning calorimeter based on the heat leak principle comprising:

a thermally conductive heat sink having a cylindrical middle section, conical end sections adjacent to both ends of said middle section, and end plates integrally attached to said conical end sections, said heat sink having a longitudinal axis through the center of said middle section, said conical end sections and said end plates;

a pair of heat capacity measuring cells symmetrically disposed within said middle section of said heat sink, one of said measuring cells containing a reference substance, and the other of said cells containing a sample substance;

a cylindrical isothermal shield attached to said end plates and surrounding said heat sink;

temperature scanning means attached to the end plates and the conical end sections of said heat sink and to said isothermal shield for adding an amount of heat to said end plates, conical and middle sections, and shield in proportion to the heat capacity of said end plates, said conical and middle sections and said shield;

temperature monitoring means for measuring the temperature of said heat sink at various points in time during a temperature scan; and

adiabatic shield means surrounding said isothermal shield for preventing heat loss or gain from said heat sink and said isothermal shield;

whereby said temperature scanning means uniformly heats said heat sink such that any thermal gradients within said middle section of said heat sink are essentially constrained parallel to said longitudinal axis of said heat sink.

2. A differential scanning calorimeter according to claim **1**, wherein each of said heat capacity measuring cells comprises:

ampoule means for containing said test or said reference substances;

cell frame means, housing said ampoule means, for supporting said ampoule means, said cell frame means thermally conductive and at least partially honeycombed such that the heat capacity of said cell frame means is reduced; and

temperature differential sensing means in contact with said heat sink and said cell frame means for measuring the temperature differential between said heat sink and said cell frame means.

3. A differential scanning calorimeter according to claim **2**, wherein said temperature differential sensing means comprises:

a pair of thermopiles, each of said thermopiles having a pair of planar surfaces, said thermopiles measuring the temperature gradient existing perpendicular to said planar surfaces, said thermopiles oriented with said planar surfaces parallel to said longitudinal axis of said middle section of said heat sink;

whereby said thermopiles are unaffected by temperature scanning thermal gradients produced in said heat sink parallel to said longitudinal axis of said heat sink.

4. A differential scanning calorimeter according to claim **2**, wherein said ampoule means comprises:

a pressurizable ampoule.

5. A differential scanning calorimeter according to claim **4**, wherein said pressurizable ampoule comprises: